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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/665,693
Filing Date: September 17, 2003
Appellant(s): AGGARWAL ET AL.

Sanjivpal S. Gill

For Appellant

EXAMINER'S ANSWER

This examiner's answer is in response to the Reply Brief filed January 26, 2009, the BPAI Remand dated 3/31/09 and the filing of a new appeal brief dated 5/1/09. This answer replaces the examiner's answer dated 11/25/08.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,481,956	HOFMEISTER	11-2002
6,395,094	TANAKA	05-2002
5,810,538	OZAWA	09-1998

6,082,948	FISHKIN	07-2000
5,944,857	EDWARDS	08-1999

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-6 & 10-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hofmeister (US 6,481,956) (previously cited) in view of Tanaka (US 6,395,094) (previously cited) and further in view of Ozawa et al. (US 5,810,538) (previously cited).

With respect to claims 1-2, 4-6, 10, 12-14, 19-22, Hofmeister discloses-

- a front docking port 24 located on a outside surface of a first substrate handling chamber 13;
- a robot arm 32 located in a first substrate handling chamber configured to access a buffer station B1-B4 and using Z-motion;
- a loadlock chamber A, B joined to a first substrate handling chamber 13; and
- a buffer station separate from a loadlock chamber A, B, a buffer station having a rack defining multiple shelves for holding substrates, FOUP cassettes 34, and wherein shelves of a buffer station rack have a pitch (10mm).

Hofmeister's buffer B1-4 is in a first substrate handling chamber, and does not disclose a buffer station directly adjacent a first substrate handling chamber being purged with inert internal environment separate from a first substrate handling chamber, or relative difference.

Tanaka discloses a buffer station 44, 46 directly adjacent a first substrate handling chamber 28, a buffer station being selectively purgeable with an inert internal environment (indicated generally as 94) separate from a first substrate handling chamber, said buffer "designed to be usually communicated with the transfer chamber 28 and to airtightly separate a space for housing therein the wafer W from the transfer chamber 28 during the preheating or cooling of the wafer" (C6/L33-37) "to prevent a gas, which has been released or exhausted from the surface of the object during preheating, and a cooling gas, which has been used for cooling, from being leaked into the transfer chamber." C3/L42-47. Therefore, it would have been obvious to one having

ordinary skill in the art at the time the invention was made to modify the apparatus of Hofmeister to include a buffer station directly adjacent a first substrate handling chamber being purged with inert internal environment separate from a first substrate handling chamber, as per the teachings of Tanaka, to contain leakage into a transfer chamber.

Ozawa et al. discloses a reduced pitch between an origination (C4/L45-53) and destination 18 such that a handler, e.g. robot arm, must account for said differences. Moreover, a skilled artisan will understand that if there is a difference in pitch one must be greater than the other. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Hofmeister's racks to include a reduced pitch as is well because where there is a difference there must be one reduced, e.g. less than the other. Ozawa et al. recognizes the transfer of multiple wafers from one location having one pitch to be placed in a wafer boat of different pitch allowing increase wafer production during one boat cycle-through. C2/L45-65. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Hofmeister et al. to include a buffer station rack having a reduced pitch relative to FOUP shelves, as per the teachings of Ozawa et al., to reduce boat cycle-through times.

With respect to claims 3 & 16, Hofmeister discloses loadlock chamber A, B is located between a first substrate handling chamber 13 and a rear substrate handling chamber 15.

With respect to claims 11 & 23, Hofmeister does not disclose a robot arm configured to employ a variable pitch end effector. Ozawa et al. discloses a variable pitch end effector (C4/L45-53) that allows multiple wafers from smaller cassettes to be placed in a single wafer boat allowing increase wafer production during one boat cycle-through. C2/L45-65. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the robot arm of Hofmeister et al. to include a variable pitch end effector, as per the teachings of Ozawa et al., to reduce boat cycle-through times.

With respect to claims 15 & 17-18, Hofmeister a loadlock chamber having a loadlock rack with a substrate capacity of less than one third of a substrate capacity of a cassette including 1 to 7 substrates. C3/L35-45.

Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hofmeister in view of Tanaka and Ozawa et al. and further in view of Fishkin (US 6,082,948)

With respect to claim 7, Hofmeister discloses a buffer station having an internal volume and does not disclose an internal volume less than or equal to about 18.3 liters. Fishkin et al. discloses a buffer station volume of 10 liters when wafers are 200 mm in diameter which facilitates rapid evacuation. C6/L30 Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Hofmeister to include an internal volume less than or equal to about 18.3 liters, as per the teachings of Fishkin, to increase throughput.

With respect to claim 8, Hofmeister discloses a buffer station rack configured to support twenty-five 300 mm silicon wafers.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hofmeister in view of Tanaka and Ozawa et al. and further in view of Edwards (US 5,944,857) (previously cited).

With respect to claim 9, Hofmeister discloses a loadlock chamber having an internal volume and does not disclose an internal volume less than or equal to about 9.156 liters. Edwards discloses loadlocks configured to have as small a volume as possible, "preferably not more than about six to eight liters and preferably only about 4.5 to 5 liters" (C11/L47-60) to improve small batch throughput. C3/L25-30. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Hofmeister to include an internal volume less than or equal to about 9.156 liters, as per the teachings of Edwards, to increase small batch throughput.

(10) Response to Argument

Claim comparison chart for response to arguments that follows.

<u>Instant Application</u>			
	<u>Hofmeister '956</u>	<u>Tanaka '094</u>	<u>Ozawa et al. '538</u>
Claim 1			
first substrate handling chamber	FIG. 2: 13, 20		
front docking port	FIG. 2: 24		

robot arm (in first sub. handling ch.; can access buffer station)	FIG. 2: 32	FIG. 1a: 34 (path of travel indicated by dotted line 36)	
loadlock chamber	FIG. 2: 16, 16 (A, B)		
buffer station	FIG. 2: B1-B4	FIG. 1a: 42, 46	
inert internal environment		C7/L1-6: "vacuum pump...capable of exhausting gas" (see also C6/L33- 47)	
buffer station rack	FIG. 2: B1-B4; C3/L35-38	FIG. 1a: 70, 90	
Claim 10			
FOUP cassette and shelves	FIG. 2: 34		FIG. 1: 25
first substrate handling chamber	FIG. 2: 13, 20		
front docking port	FIG. 2: 24		
robot arm (in first sub. handling ch.)	FIG. 2: 32	FIG. 1a: 34 (path of travel indicated by dotted line 36)	FIG. 1: 23

loadlock chamber	FIG. 2: 16, 16 (A, B)		
buffer station	FIG. 2: B1-B4	FIG. 1a: 42, 46	
purging (of buffer station)		C7/L1-6: "vacuum pump...capable of exhausting gas" (see also C6/L33-47)	
buffer station rack having multiple shelves of reduced pitch	C3/L35-37	FIG. 1a: 70, 90	FIG. 1: 25; C4/L45-53
Claim 14			
substrate handling chamber	FIG. 2: 13, 20		
front docking port	FIG. 2: 24		
purgeable buffer station	FIG. 2: B1-B4	C7/L1-6: "vacuum pump...capable of exhausting gas" (see also C6/L33-47)	
buffer station rack	FIG. 2: B1-B4;	FIG. 1a: 70, 90	

having multiple slots	C3/L35-38		
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Claims 1, 10, 14

In response to Appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the cited prior art are analogous for at least the reason that both Hofmeister and Tanaka disclose moving wafers between cassettes and process chambers using a robot arm and buffer stations. In addition, they achieve the predictable result of providing a temporary storage location during substrate movement so that a supplemental process may be performed such as aligning, cooling or heating.

Hofmeister's buffer stations B1-B4 achieve the predictable result of placement of substrates coming from or going to load lock chambers 16, 16 where pre or post processing of wafers, e.g. alignment, is required during transfer to/from a cassette. Tanaka discloses that a buffer "capable of causing a plurality of wafers W to stand by for timing is provided in place of the load-lock chambers 8A and 8B capable of being evacuated." Tanaka teaches that "timing" equates to a supplemental process such as cooling, i.e. wafer in transit from a process chamber to a cassette, and heating, i.e.

wafer in transit from a cassette to a process chamber. Thus, both Hofmeister and Tanaka achieve the predictable result of a temporary storage space for substrates (e.g. wafers) in transit so that a supplemental operation can be performed prior to placement in a process chamber or cassette. Moreover, Tanaka adds the ability of a separately purgeable buffer, to keep a transfer chamber contamination free. C6/L33-47.

Whether a skilled artisan would have added Tanaka's purgeable buffer based on the lack of need in Hofmeister is irrelevant to the question of obviousness. The issue is whether taken as a whole the cited prior art discloses the need to add a feature in a modifying reference. In this case, Hofmeister does not disclose purgeability which Tanaka's adds to prevent contamination of a substrate handling chamber as noted above.

Appellant's argument that Tanaka discloses buffering only one wafer is factually incorrect. Tanaka discloses top shelf 64 upon which a wafer is placed and a bottom shelf 80 upon which an additional wafer is placed. Regardless, Hofmeister discloses racks having shelves (C3/L34-37) which Tanaka discloses can be placed into a separate, purgeable chamber 44, 46 joined to a first substrate handling chamber to maintain a clean environment, separate from a transfer chamber. Thus, where Tanaka discloses multiple shelves Hofmeister discloses multiple shelves as well.

Appellant argues that Asawd discloses that "standard cassette racks" that can sustain heating beyond 170 degrees C are too expensive and one skilled in the art would not have has a reasonable "expectation of success for the Office Action's proposed modification of Hofmeister's buffer cassettes B1-B4 to act as substrate cooling

stations. Appellants respectfully assert that had the skilled artisan desired to provide a substrate cooling station in Hofmeister, he or she would have opted to provide a single-substrate cooling station (such as Tanaka's cooling unit 50) in addition to the buffer cassettes B1-B4, as opposed to converting one of the buffer cassettes B1-B4 into a cooling station." (Brief pages 16-17) Aswad clearly discloses "cassettes are available that can handle wafers as hot as 170°C." albeit relatively expensive. Aswad's teaching clearly does not rise to teaching away from the combination. Again, Hofmeister discloses buffer racks within a transfer chamber and Tanaka provides a separate chamber which a skilled artisan understands to be merely reconfiguring well known components to provide a contamination free transfer chamber. As discussed below the claim 1 and 10 do not require heating or cooling.

The following address Appellants Jan. 26, 2009 Reply Brief.

Reply Brief P2.

With respect to claims 1 & 10, Appellants arguments that a skilled artisan would not have combined a multi-wafer buffer with a system that purges single wafers purging are unsupported by the full record. Appellant essentially argues that a skilled artisan would not have combined Hofmeister's multi-shelved buffer with Tanaka's single wafer purging because a system designed for purging a single wafer cannot purge multiple wafers. Initially, as noted above Tanaka discloses buffering at least two wafers on support shelves 44, 46 along with a multi-wafer exhaust system 75, 96. (C7/L1-6; C6/L33-47). And, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention

where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In this case, Tanaka buffers, and subsequently heats/cools, wafers to simply save time because a problem existing in current semiconductor manufacturing is that the processing requires "about 60 to 90 seconds, which is some longer than the time required to carry out...preheating." C2/L30. Thus, the addition of purging of multiple wafers allows processing time to be absorbed and improves throughput of a transfer arm. C2/L46-53.

Appellant argues that Tanaka's purging cannot be added because Hoffmeister does not require heating or cooling. Tanaka's purging is to provide a time-saving time of heating or cooling multiple wafers during buffering to saving manufacturing time where process chambers slow total wafer throughput. And, as noted above the ability to purge a buffer station improves throughput.

Reply Brief P3-4.

Tanaka discloses multiple shelves (FIG. 2: 64, 88) both of which are purged. Claims 1 & 10 do not recite heating or cooling. Thus, the combination is strictly based on the need for a purged atmosphere during buffering. And, Tanaka's two buffer shelves allow temporary storage for wafer's moving to/from process chambers, aligners and loadlocks. Again, the general concept is to improve throughput, a predictable result.

Tanaka was not offered as citing the ability to simultaneously cool/heat multiple wafers, but merely the ability to buffer multiple wafers in a purgeability environment as required in the claims. The motivation well known by skilled artisans is that certain

processes during a wafers manufacture will take more time than others. For example Tanaka discloses that process chambers may take 60 seconds, e.g. timing, whereas arm movement requires less; buffering allows for an arm to move wafers to/from a loadlock while having a holding place for wafers moving to/from process chambers. See general discussion in column 2 of Tanaka.

Reply Brief P4-5.

Appellant argues that because Hoffmeister does not require purging that a skilled artisan would not have been motivated to adding Tanaka. Tanaka adds purgeable buffers to improve throughput which is a recognized deficiency in the art at the time of Tanaka. See Tanaka C2/L30.

Reply Brief P5.

The fact that Hoffmeister's shelves could not support heating/cooling is unsupported by the full record as to teach away from a combination. Assuming Appellants arguments Aswad merely discloses an upper limit to a heating temperature and not total failure of a Hoffmeister's buffer shelves to support wafers. Using Asawad a skilled artisan would know the upper limit to heating temperatures, perhaps taking longer because of the lower temperatures. And, merely surpassing 170 degrees C does not mean that a Hoffmeister's shelves fail because the material of construction is unknown. Using the teachings of Aswad a skilled artisan would use the type of material in Tanaka's buffer shelves to prevent failure using Tanaka's heating.

Claims 7-8

There is no separate argument regarding the deficiencies of Fishkin. If the rejection with respect to claim 1 is affirmed this rejection should be affirmed as well.

Claim 9

There is no separate argument regarding the deficiencies of Edwards. If the rejection with respect to claim 1 is affirmed this rejection should be affirmed as well.

Claim 14

Appellant defines pitch as "a rack with reduced pitch, or relative spacing between shelves, as compared to standard cassettes or FOUPs for the same size of substrate." See Appellants Specification Para. [0010]. Hofmeister discloses a standard cassette as "cassettes are well known in the art" supporting either "thirteen or twenty-five substrates" and buffer racks designed to have "a capacity to hold 26 wafers each with a 10mm pitch". C3/L7-10; C3/L36-38. Hofmeister further discloses more wafers in a buffer station rack compared with cassettes. Thus, Hofmeister discloses a standard pitch in a FOUP cassette 34 and a 10mm pitch in a buffer rack and does not disclose a cassette pitch. Ozawa also discloses more substrates in a buffer station rack 18 compared with a cassette. Ozawa further discloses that robot arm 23 that transfer multiple substrates between two sets of shelves is "designed in such manner that its pitch can be changed to match the difference of a wafer accommodating pitch of the wafer cassette and a wafer accommodating pitch of the boat 18", e.g. buffer rack. Thus, Ozawa confirms that where differences in pitch occur it is a buffer station rack 18 that must be accommodated because it will be less than a cassette, because a buffer station rack must hold more substrates.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Gregory W. Adams,

/Gregory W Adams/

Primary Examiner, Art Unit 3652

Conferees:

Saul Rodriguez /sjr/

Darnell Jayne /dj/